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The present invention relates to a method and device for working paper, board, or similar. More specifically, the scope of the aforesaid working may encompass scoring, perforation, punching, creating an opening, trimming, and other operations, which are performed on paper, board, and similar products, such as plastic films and sheets, and adhesive labels on backing sheets. In certain cases, the paper or paper-like products may be worked in bundles, with two or more sheets on top of each other.

Scoring, for example, takes place at present mainly in relatively large devices of the printing press type, in which there is a rotating roller, with suitable blades for carrying out the desired operation attached to its surface. Thus, scoring, for example, takes place by the blade attached to the aforesaid roller press the paper, board, or similar against a counter-surface, and simultaneously scoring it. If it is intended to carry out perforation, the blade has a suitable edge, part of which is intended to penetrate the paper or similar. Similarly, a blade can be used to cut an adhesive label attached to a suitable backing into appropriate parts, without nevertheless touching the backing. Of course, scoring can also be carried out using a manual device or a device in which motion is created by an electric motor.

A drawback in the cases described above is the large size and cost of the devices required. An additional drawback is that a large and clumsy and relatively heavy device cannot be sensibly attached to form a part of another device, such as a printing press or copier. Instead the device is, and must remain separate. Naturally, there is a great difference in the amount of work needed when using two separate devices and when using a single device, in which another apparatus carries out another stage of the work. A manually operated device driven by muscle power is, in turn, slow and cumbersome to operate, while a device driven by a electric motor is slow, as it requires the rotation of the motor to be started, the work to be carried out, and the motor to be stopped.

The present invention is intended to create a method and device, by means of which the drawbacks referred to above can be eliminated and by means of which

any of the work stages referred to above or not referred to above can be carried out flexibly, with a minimum of labour, and efficiently.

5 The above and other advantages and benefits of this invention are achieved in the manner described in the characterizing sections of the accompanying Claims.

10 In the following, the invention is described in greater detail, with reference to the accompanying drawings, which show some general principles of some embodiments of the invention, without the invention being limited to them in any way. It is self-evident, that many of the technical solutions in the embodiments presented can be replaced with other technical solutions, without, however, deviating from the basic principles and spirit of the invention.

15 Certain physical solutions are described in the drawings, while, for the sake of clarity, leaving out many parts of the device that are known from other contexts. The method according to the invention is explained by describing the devices shown in the drawings.

20 Thus:

Figure 1 shows a side view of a simplified diagram of one embodiment of the device according to the invention;

25 Figure 2 shows another alternative, also in side view;

Figure 3 shows a similar view of a third embodiment; and

30 Figure 4 shows yet another alternative way to construct a device according to the invention.

The basic principle of the invention is to use a high-speed, precise, and easily controlled electromagnetic force to carry out any operation, such as scoring, belonging to the area. An electromagnetic force is naturally known in many

connections but its application in this area is an insight that opens many possibilities.

5 Thus, Figure 1 shows one embodiment of the invention in a simplified diagram that only shows the basic principle, and which lacks many accessories not necessary to illustrate the principle according to the invention. The method according to the invention will become apparent from the description of the device. Thus, the device 1 includes a component 2, which is attached to a frame not shown in the figure in any great detail, and which is made from a material (magnetizable material), especially iron, that is moved by a magnetic force. This component may be guided by guide rails, which are also not shown in the figures.

Specifically in this embodiment, the electromagnetic component, which is generally marked with the reference number 3, is regarded as a fixed piece and component 2 as a moving piece, though in fact the reverse may be true, or both components 2 and 3 may move. The figure also shows component 2 as being the upper piece, but component 2 may be just as well and perhaps preferably the lower piece, i.e. the whole drawing would also be valid if turned through 180 degrees. The components can also be turned to any other angle at all.

20 If desired, both components can also be magnetized with like poles or opposite poles, creating an attracting or rejecting movement, thus allowing the electromagnetic control of the movement in both directions and further accelerating the operation. The magnitudes of the forces acting in different directions can be adjusted to be equal or different.

Figure 1 shows an end view of the device. This means that the width of the whole device is at least as great as that of the widest paper to be scored or otherwise worked. For example, the width of the device, seen directly in the figure in a direction away from the eye of the viewer, may be 30 cm or more. However, the paper 4 may also travel in the manner shown, if the device is narrower than the paper, but with scoring or another operation only being carried out in the area delimited by the device.

A component assembly 3, in which there is an electromagnetic construction comprising an iron core 31 and coils 32, 32, is also attached to the same or a separate frame. When an electrical current is connected to coils 32, an electromagnet is created, which strongly attracts component 2 to it. If the attachment of component 2 to the body is made flexible or moveable, component 2 will move towards and onto electromagnet 3, unless the movement is otherwise limited to stop before contact has been made. However, a suitable flexibility or movement can be created in many different ways.

A holder 33, for scoring blade 32 or for devices for other purposes, is in the same totality as the electromagnet. Correspondingly, component 2 has a suitable groove 22, so that, when component 2 moves rapidly towards the electromagnet, the paper, board, or similar 4 remains between scoring blade 34 and counter-piece 21, thus creating a groove in it. If groove 22 is broader and deeper than shown in the figures, a fold can be created in the paper or board.

It is obvious that the invention will function just as well in scoring, making holes, for example, for filing or binding, creating a perforation for tearing, making an opening, or cutting, or some other operation. Therefore the replacement of blade 34 is arranged simply so that the blade is in a suitable, tight groove in the same frame as the electromagnet. Number 35 refers to a suitable material, in which the retaining groove has been made. Blade 34 can be changed by removing the old blade by pulling it to the side or lifting it out of the groove, then pushing the new blade in. Replaceable blades can be made in different thicknesses for scoring, or, instead of scoring, the blade may be such that it can be used for perforation or making holes, or for shaping a metal wire that binds sheets of paper together, etc.

Figures 2 and 3 show a adapted embodiment of the device according to Figure 1. Thus, in both figures, the 'blade' 34 is attached to the body diagrammatically, at the point marked by the line 36, for example, by means of threads or in some other suitable manner, particularly by using some rapidly openable/closable attachment system, many of which are known in different fields. The blade in Figure 2 can be flat at the end facing component 2, so that it can be used, for example, for laminating, especially if it can be heated. Another possible alternative for the blade

to have a suitable patterning, which is impressed in the paper, board, plastic, or similar. This might be raised patterning or Braille printing. Further, the blade can be adapted for some particular form of wire binding, to close a binding wire.

- 5 Figure 3 shows a perforation version. Thus, in component 2 there is a hole, or a material 23 acting flexibly as a cushion, into which a perforation bit 37 at the end of blade 34 enters, to make a hole in the paper or similar. Other applications, such as cutting or making an opening, can be easily constructed on the basis of the above.
- 10 Figure 4 shows one means of creating movement in component 2. In this case, component 2 is suspended, by bolts 24 or similar, in a cradle 25 attached, by bolts 26 or similar, to the frame of the device, which is not shown in the figures. The flexibility that allows component 2 to move towards and away from magnet 3, is achieved by either the flexible attachment of bolts 24 and/or 26, or by making
- 15 cradle 25 from a material that flexible enough to permit the movement. Many other kinds of suspension or attachment are obviously possible.

The method and device according to the invention are extremely fast, compared, for instance, to the much used embodiment driven by an electric motor. In the

20 embodiments shown in the figures, the force is transferred entirely to the movement required to carry out the operation and to carrying out the task. However, the invention can also be applied in such a way that the force is transmitted to its object through a suitable system of levers. In this case too, the lever system is extremely simple and the loss of power small.

25 As stated above, the device according to the invention is very fast. Thus, if a more powerful scoring or other operation is desired, a double impact, or multiple impacts can be made, so that the score made by them in the paper or board or similar will naturally be greater than that made by a single impact.

30 A multiple impact is useful when using an opening blade, when the device according to the invention can be used for making openings in thicker grades of board, or simultaneously in many layers of paper or board, by hacking a punch or other blade at a high or relatively high frequency through board, paper, or pile of

board, or paper. In this case, the blunting of the blade can be compensated for by the number of impacts, while increasing the number of impacts will allow the same device to penetrate more resistant material. It is also possible at the same time to adjust the distance between the magnetized surfaces, or the current to the magnetic coils, to vary the impact force as required.

In the device according to the invention, the time between the operations being carried out can be exploited by using the current to charge batteries or capacitors, when power can be recharged for the next work stage during the rest period before it. This will, for example, reduce external interference to telephone traffic, compared to the power required for electric motors. The advantages of the device, when used in operations that are repeated many times in sequence, increase in proportion to devices driven by electric motors, because in electric motor solutions it is extremely difficult to carry out the starting stage, work stage, and stopping stage at a rapid tempo.

As stated above, the device can be as broad or broader than the piece being worked, but may also be narrower, depending on the circumstances. The force is directed uniformly over the entire width, unlike in devices, in which, for example, an axle is rotated from its end, so that the forces transmitted over the length of the axle may vary at different points, due to distortion and similar causes.

It is clear, that the operating position of the device is a factor of secondary importance in the device and the application of the principle according to the invention. The device is simple and is extremely reliable. In addition, a device according to the invention is small and compact. Thus, it is suitable for installation, for example, as part of a printing press or copier, so that scoring, perforation, or similar operations can be carried out on the paper being copied or printed, directly after the copying or printing line. This will save a great deal of time and obviously simplify the handling of the paper, because it eliminates many of the transfers and adjustments of the paper previously necessary out as intermediate work stages.

Several devices according to the invention can also be set side by side, when the operating area may be very great. The movement created by the electromagnet

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can also be transmitted, for example, outside the area of electromagnet 2 by, for instance, placing scoring blades at the ends of component 2. There are numerous functioning variations that come within the scope of protection of the invention.

- 5 If, in practice it is sensible to construct the device according to the invention as two or more parts, this can be done easily by, for example, locating the parts either sequentially or also beside each other. In practice, in other words, a certain length can be formed of two or more sequential parts, with the total length desired.
- 10 The invention can be adapted in many ways, while nevertheless remaining within the scope of the protection of the inventive idea and the accompanying Claims.